Software Reuse

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Two Notices

- 8110.Reuse
  - Reuse of software life cycle data
  - Near completion
- 8110.RSC
  - Reuse of entire components
  - In and across company boundaries
  - Targeted completion in late 2001

8110.Reuse

Entitled:

"Guidelines for Approving Reused Software Life Cycle Data"

9 Sections

- *1-3: Purpose, Distribution, Related Publications*
- 4: Definitions
- 5: Background
- 6: Safety Considerations
- 7: Factors Affecting Reuse
- 8: Reuse Approval Guidelines
- *9: Conclusion*

Section 4 - Definitions

Original Certification Project	First use of the reusable software life cycle data.
Subsequent Certification Project	Follow-on project that reuses data from the original certification project.
Reuse	Subsequent use of unaffected, previously approved software life cycle data
Certification Credit	Acceptance that a process or product meets the certification requirements.

Section 4 – Definitions (cont)

Software Life Cycle Data	Data produced during the software life cycle. Also known as the DO-178B, Section 11 data.
Configuration Item	1) One or more software components treated as a unit. 2) Software life cycle data treated as a unit.
Software Configuration Index	Identifies configuration of an item. Contains one or more configuration items.
Software Life Cycle Env. Index	Identifies configuration of the software life cycle environment.

Section 4 – Definitions (cont)

Software Plans & Standards	Data that directs the development & integral processes.
Software Tool	Computer program used to develop, test, analyze, produce, or modify another program or its documentation.
Tool Qualification	Process necessary to obtain cert credit for a tool.
Software Library	Collection of software and related data/ documents.

Section 5 - Background

- **Notice applies to reuse of software life cycle data**
- **Reusable Components are addressed in a separate notice.**
- **Good packaging is needed to maximize reuse.**

Examples of Good Packaging

- **Develop plans and standards to be as "generic" as possible, with project-specific information in the PSAC.**
- **Build and package the software so it can be used on multiple projects**
- **Tool qualification data separate for tools used on all software projects**
- **Make individual configuration indices (CIs) for components that may later be reused**
- **Design the software components for reuse (high cohesion, low coupling)**

Section 6 – Safety Considerations

- **Intent is no review of data needed by ACO, so . . .**
- **To make sure that safety is addressed:**
  - **No effect on safety margins, operational capability or functions or crew workload should occur**
  - **Reused data should not change and should be applicable**
  - **Agreement with ACO early in project should be obtained**

Section 7 – Factors Affecting Reuse

- **7a – Any Section 11 data can be reused if:**
  - **It remains unchanged**
  - **It is applicable to the project**
  - **No safety issues exist (as described in Section 6)**
- **7b – In-service problems might limit reuse**

Section 7 – Factors Affecting Reuse (cont)

- **7c – Open problems reports should be analyzed prior to reuse**
- **7d – Assessment should be performed to show similarity of operational environment and safety assessment**
  - **Builds on 7a and 7c**

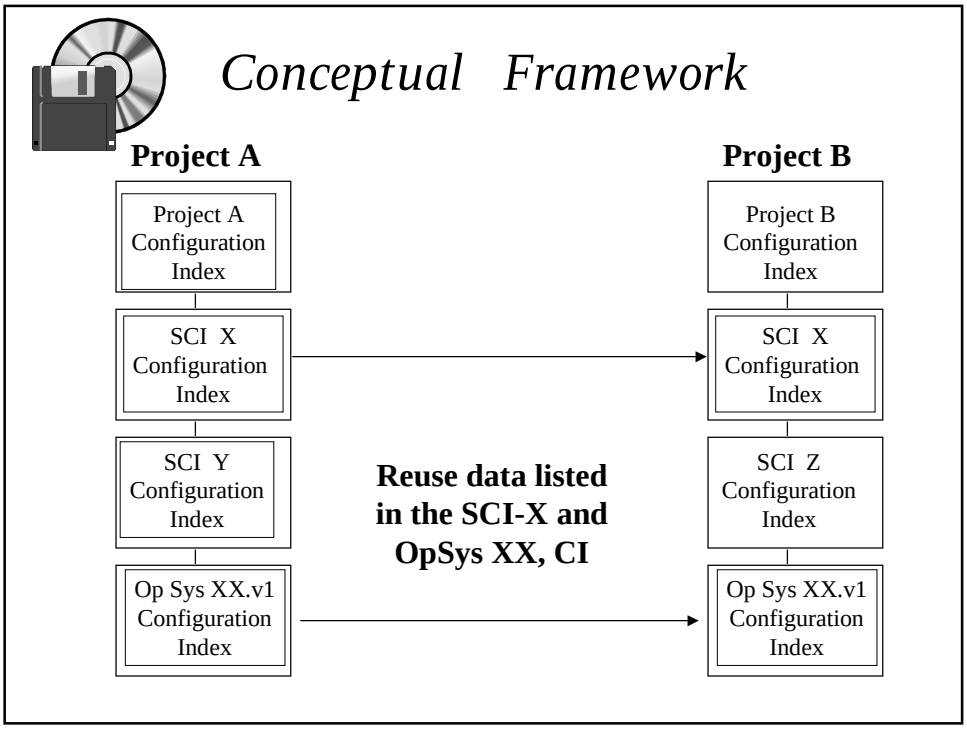
Section 8 – Reuse Approval Guidelines

- **Ensure that data to be reused is unchanged.**
- **Ensure that the software level is equivalent or less than previous approval.**
- **Ensure that the range & data type of inputs are equivalent to previous approval.**
- **Ensure that the configuration items are used on the same target environment.**
- **Ensure that the PSAC documents the reuse intent and rationale.**

Section 8 – Reuse Approval Guidelines (cont)

- **Examples of items suitable for reuse:**
  - **Software plans and standards**
  - **Tool qualification data**
  - **Software libraries**
  - **Software requirements, design, code, & verification data**
  - **Configuration items**

FAA National Software Conference, June 2001
Software Reuse



Summary of Reuse of 8110.Reuse

- **Reuse of software life cycle data on multiple certification projects is feasible**
- **If a data item hasn't changed and is applicable for the current project, it is a candidate for re-use**
- **Present plan for reuse in PSAC and get early ACO agreement**

8110.RSC

Entitled:

"Guidelines for Accepting
Reusable Software Components"

<u>Goal</u>: To be able to carry certification "credit" for reusable software component from one project to the next

10 Sections

- *1-3:* *Purpose, Distribution, Related Publications*
- 4: Definitions
- 5: Background
- 6: Discussion
- 7: Guidelines
- 8: Common Reuse Issues and Considerations
- 9: Changes to Components
- *10:* *Conclusion*

Section 4 - Definitions

- **Reusable software component (RSC) is the software code and its supporting DO-178B documentation being considered for reuse. It forms a portion of the software that will be implemented by the integrator/applicant.**
- **Reusable software component developer (RSCD) is the manufacturer of the reusable software component.**

Section 4 – Definitions (cont)

- **Integrator is the manufacturer responsible for integrating the re-useable software component into the target computer and with other software components.**
- **Applicant is the manufacturer seeking certification or authorization of the overall system.**

Section 5 - Background

- **Traditionally, software approval is at the system level.**
- **There is currently no vehicle to carry certification credit across project boundaries.**
- **Purpose of this notice is to provide guidelines for allowing "credit" across projects.**

Section 5 – Background (cont)

- **RSC Examples:**
  - **Operating Systems**
  - **Libraries**
  - **Input/Output Data Files**
  - **Loading Software**
- **Guidelines are applicable within a company or across company boundaries.**

Section 6 – Discussion -Stakeholders-

Integrator

Reusable Software Component Developer (RSCD)

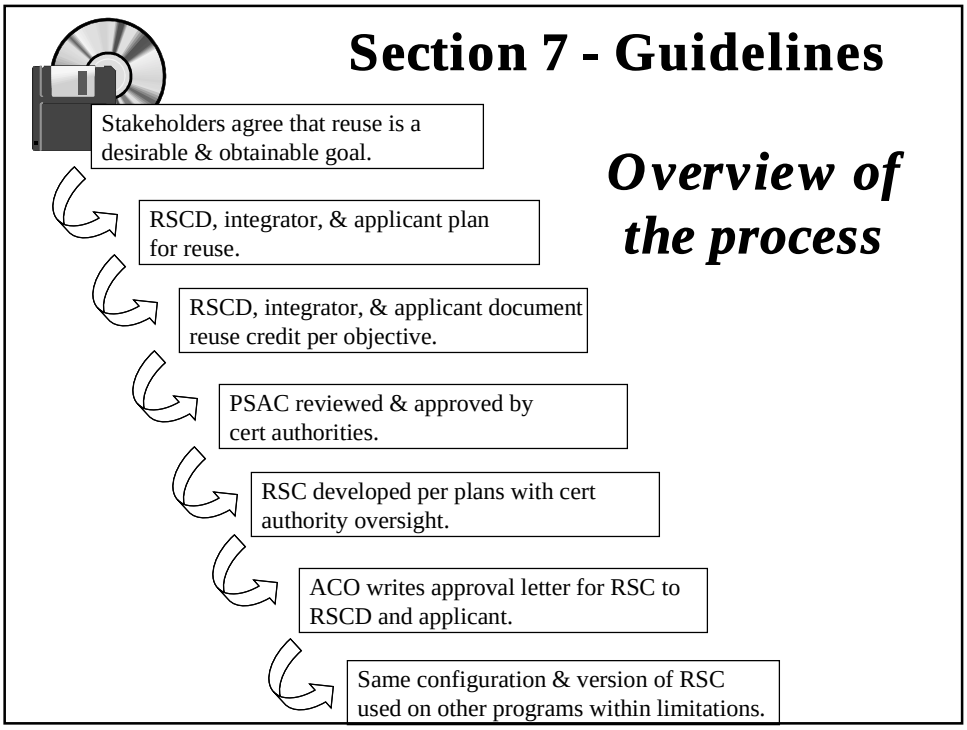
Applicant

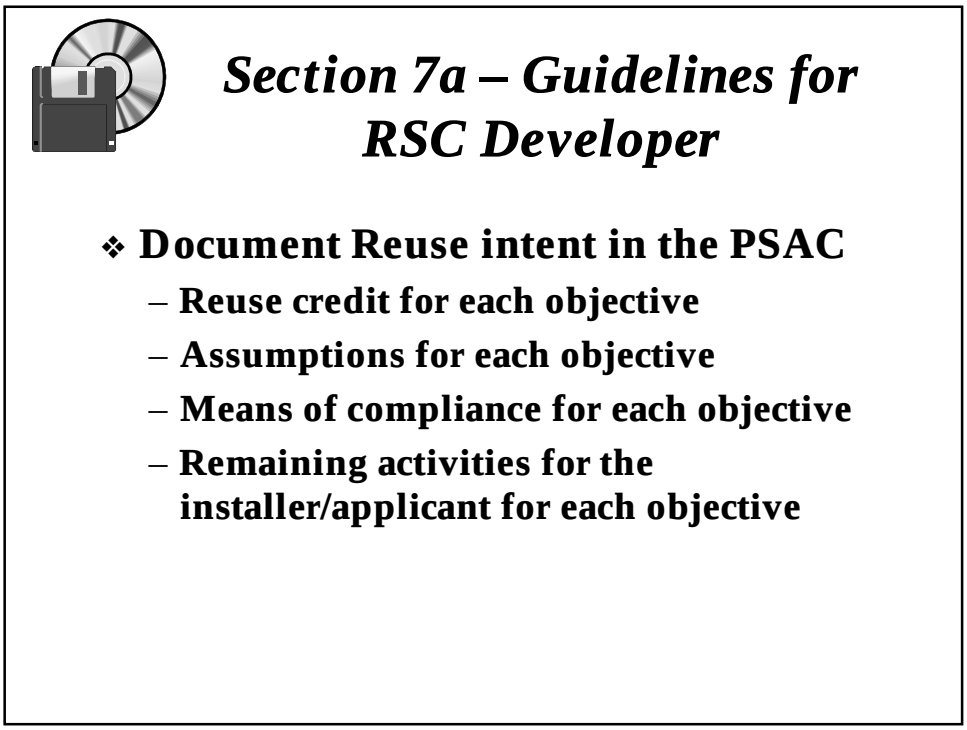
Certification Authorities

Note: Cert authorities may have more involvement than a traditional software development project for the initial component development.

Section 6 – Discussion & Procedures (cont)

- **Scoping the RSC guidelines:**
  - **6a – First acceptance of RSC is a "real" project**
  - **6b/c – Stakeholders agree on reuse**
  - **6d – Each project is unique and might have different "credit"**
  - **6e – Applicant is responsible for final cert**


Section 7 - Guidelines
Overview of the process
Stakeholders agree that reuse is a desirable & obtainable goal.
RSCD, integrator, & applicant plan for reuse.
RSCD, integrator, & applicant document reuse credit per objective.
PSAC reviewed & approved by cert authorities.
RSC developed per plans with cert authority oversight.
ACO writes approval letter for RSC to RSCD and applicant.
Same configuration & version of RSC used on other programs within limitations.


Section 7a – Guidelines for RSC Developer
Document Reuse intent in the PSAC
– Reuse credit for each objective
– Assumptions for each objective
– Means of compliance for each objective
– Remaining activities for the installer/applicant for each objective

Example Approach

Obj #	Obj Description	Credit Sought	Assumption	Activities Remaining For Integrator/Applicant
1-1	Software development and integral processes activities are defined. 4.1 a, 4.3	Full	ACI's plans are completed and not changed for the RRI.	The integrator/applicant will need to create a system level PSAC that references the ACI documents. The ACI software package should be referenced in the applicant's "additional considerations" section(s). Other plans by the applicant will address their specific implementation of the ACI software.
1-2	Transition criteria, inter-relationships and sequencing among processes are defined. 4.1b, 4.3	Full		The applicant's plans should address how the ACI software is transitioned into the applicant's system.

- **Document objective, credit sought, assumptions, and remaining activities in the PSAC and Accomplishment Summary**

Example Approach (cont)

- **Address target dependencies.**
- **Address assumptions regarding requirements; particularly high-level requirements.**
- **Be specific and thorough.**
- **Obtain FAA input & agreement on proposals up-front.**

Example of Partial Credit

- Objective 1-1: **Software development and integral processes activities are defined.**
- Credit Sought: **Full**
- Assumptions: **Plans are completed and unchanged for router.**
- Remaining Activities: **Applicant/integrator to complete LRU level plans, reference router plans/data, & consider reuse in "Special Considerations"**

Example of Partial Credit (cont)

- Objective 2-1: **High-level requirements are developed.**
- Credit Sought: **Partial**
- Assumptions: **Assuming high level requirements are document XXX, revision - and the LRU manufacturer uses those requirements.**
- Remaining Activities: **Because the high-level requirements actually exist at the LRU level, they cannot be fully implemented at the software component level. The applicant may reference and tie to the component-level high-level requirements as their own high-level requirements. If this occurred, the applicant would also need to verify the high-level functionality of these requirements in their system.**

Section 7a (cont) – Other Responsibilities of RSC Developer

- **Document safety-related issues**
- **Coordinate & follow plans with all stakeholders**
- **Submit SAS and SCI at end of project, with the completed compliance tables**
- **Supply data to support the type certificate to the applicant**

7b – Integrator/Applicant Responsibilities

- **Integrate RSC data into the project data**
- **Specify the life cycle data needed from the applicant**
- **Consider safety issues of the RSC**
- **Coordinate & follow plans**
- **Consider open PRs of the RSC**
- **Validate assumptions made by the RSC developer**
- **Complete the RSC objectives tables in the SAS**

7c – Cert Authority Guidelines on 1st Approval of the RSC

- **Involve all stakeholders**
- **Involve technical experts, as needed**
- **Review plans of RSC developer and 1st applicant for consistency**
- **Perform reviews, as needed**
- **Approve project, when objectives are satisfied**
- **Write letter for RSC developer explaining acceptance, limitations, etc.**

7d – Cert Authority Guidelines on Subsequent Use of RSCs

- **Review the acceptance letter**
- **Contact ACO engineer who did the original acceptance, if needed**
- **Ensure that the applicant follows the guidelines of this notice**
- **Perform reviews of project plans and data**
- **Ensure consistency between RSC plans/data and applicant's plans/data**
- **Inform original ACO of subsequent use/approval of RSC**

Section 8 – Common Issues & Considerations

- **High-level requirements objectives**
- **Re-verification issues**
- **Interface documents**
- **Partitioning/Protection Considerations**
- **Safety issues**
- **Coupling & Cohesion**

Section 9 – Changes to RSCs

- **When RSC is changed, cannot be reused without another reuse application.**
- **Changes to RSC may or may not affect all users.**

Issues Still In Work

- **Unused portions of RSC**
  - **Are they dead or deactivated code?**
- **Notice vs. Advisory Circular**

Summary

- **We are making progress in addressing software reuse**
- **8110.Reuse is near completion**
- **8110.RSC is planned for release in late 2001 or early 2002**
- **Tool qualification reuse is to be addressed in future policy**
- **The reuse breakout session tomorrow will provide some additional reuse information**
- **A video on reuse is planned for September**